

ElementMatrixAssembler library

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1 Equations and nomenclature

1.1 Stationary mass conservation

$$-\vec{\nabla} \cdot \vec{N}_i + R_i = 0$$

with

$$\vec{N}_i = c_i \vec{v} - \sum_j D_{ij} \vec{\nabla} c_j - w_i c_i \vec{\nabla} U$$

- D_{ij} is the diffusion factor.
- $w_i c_i$ is the migration factor.

1.2 Electrostatics

$$\vec{\nabla}^2 U + \frac{F}{\epsilon} \sum_i z_i c_i = 0$$

- The electrostatics potential factor is 1 if you use Poisson and 0 if you use electroneutrality.
- $\frac{z_i F}{\epsilon}$ is the electrostatics concentration factor if you use Poisson and z_i if you use electroneutrality.

1.3 Butler-Volmer kinetics

$$v = k_{ox} \exp \left[\frac{\alpha_{ox} n F}{RT} (V - U) \right] c_{red} - k_{red} \exp \left[-\frac{\alpha_{red} n F}{RT} (V - U) \right] c_{ox}$$

2 Include

Additional Include Directories: ElementMatrixAssembler\include
In your code: `#include "ElementMatrixAssembler.h"`

3 Functions

3.1 Constructor

Pass the number of dimensions, the MITReM object and the names of the numerical schemes to use.

3.1.1 Convection schemes

- Empty
- N
- LDA

3.1.2 Diffusion schemes

- Empty
- DualMesh

3.1.3 Migration schemes

- Empty
- DualMesh

3.1.4 Homogeneous reaction schemes

- Empty
- DualMesh

3.1.5 Electrostatics schemes

- Empty
- DualMesh

3.1.6 Time schemes

- Empty
- DualMesh

3.1.7 Electrochemical reaction schemes

- Empty
- DualMesh

3.2 calcElementMat

Returns the element matrix. Pass the coordinates, the velocities, the concentrations, the potentials, the temperatures, the densities and the void fractions in the nodes of the element.

3.3 calcElementJac

Returns the element jacobian. Pass the coordinates, the velocities, the concentrations, the potentials, the temperatures, the densities and the void fractions in the nodes of the element.

3.4 calcBoundaryElementVec

Returns the boundary element vector. Pass the coordinates, the concentrations, the potentials, the temperatures, the densities and the void fractions in the nodes of the boundary element, and also the list of electrochemical reaction indices and the length of this list and the electrode potential.

3.5 calcBoundaryElementJac

Returns the boundary element jacobian. Pass the coordinates, the concentrations, the potentials, the temperatures, the densities and the void fractions in the nodes of the boundary element, and also the list of electrochemical reaction indices and the length of this list and the electrode potential.